

NASA TECH BRIEF



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High-Torque Power Wrench, A Concept

The problem:

A need exists for a power torque wrench small enough to be handled by one or two men yet with sufficient torque to remove 1-1/2- to 4-inch nuts from high-pressure tanks and valves. Frequently, nuts are "slugged" on the studs, making the nuts extremely difficult to remove should the necessity arise. Torque wrenches of the size required are not commercially available.

The solution:

Design a power torque wrench that has the capability of exerting an amount of controlled pressure within the desired limits.

How it's done:

This design concept consists of a 10,000-psi hydraulic ram that operates a dual-pawl onto a ratchet which, in turn, has a square hole for an adapter to receive regular power-drive supersockets. A counter-acting arm is connected to the ram and is adaptable to a hex-socket wrench to receive nuts or round female adapters for studs. This is a power-stabilizing arm to counteract the torque output from a selected fixation point. The arm can be pivoted from the body of the wrench to adjust to various anchor points. With a regulated hydraulic power supply, the "on torque" may be uniformly applied and monitored by use of a high-pressure gage. The "on" or "off" motion is accomplished merely by turning the wrench over.

Wrench stroke drives the link arm through a 30-degree arc, and it is used only in the final stages of torque, either on or off.

Notes:

1. If desired, the action can be made automatic by use of solenoid-operated valves and suitable switches. Two wrenches have been designed, one weighing 60 pounds and having a 7300-ft-lb capacity and the other weighing 120 pounds with an 18,000-ft-lb capacity.
2. Critical analysis of this design indicates a minimal deflection of the hydraulic cylinder about the fixed pivot point during the stroke of the piston-ram. This deflection results in an error of less than 0.02 percent of the rated torque value; i.e., at 7300 ft-lb, the error, not including friction, would be less than 1.5 ft-lb.
3. This development is in conceptual stage only, and, as of date of publication of this Tech Brief, neither a model nor prototype has been constructed.

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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Category 05

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High-Speed Flow Field Measurements

The present report describes the results of a series of experiments conducted in the Langley Research Center, NASA, to determine the accuracy and range of application of the laser Doppler velocimetry (LDV) technique for measuring high-speed flow fields. The experiments were conducted in the Langley 11-Foot Open Jet Facility, which is a closed-circuit, open-jet, supersonic flow facility. The flow is accelerated from a reservoir at 100 psia and 540°R to a nozzle exit where the static pressure is 1.5 psia and the static temperature is 1000°R. The flow is then accelerated through a convergent-divergent nozzle to a test section where the static pressure is 0.1 psia and the static temperature is 1000°R. The flow is then decelerated through a divergent nozzle to a settling chamber where the static pressure is 1.5 psia and the static temperature is 1000°R. The flow is then exhausted to the atmosphere through a nozzle. The flow is measured at various Mach numbers from 0.5 to 2.0. The results of the experiments are presented in the following sections.

1. Introduction

The laser Doppler velocimetry (LDV) technique is a non-intrusive method for measuring the velocity of a fluid flow. It is based on the principle of the Doppler effect, which states that the frequency of a wave changes when the source and the observer are moving relative to each other. In the case of LDV, the source is a laser beam and the observer is a photodetector. The laser beam is directed at the flow, and the light scattered by the flow is detected by the photodetector. The frequency of the scattered light is then measured, and the velocity of the flow is determined from the Doppler shift.

2. Experimental Setup

The experiments were conducted in the Langley 11-Foot Open Jet Facility, which is a closed-circuit, open-jet, supersonic flow facility. The flow is accelerated from a reservoir at 100 psia and 540°R to a nozzle exit where the static pressure is 1.5 psia and the static temperature is 1000°R. The flow is then accelerated through a convergent-divergent nozzle to a test section where the static pressure is 0.1 psia and the static temperature is 1000°R. The flow is then decelerated through a divergent nozzle to a settling chamber where the static pressure is 1.5 psia and the static temperature is 1000°R. The flow is then exhausted to the atmosphere through a nozzle. The flow is measured at various Mach numbers from 0.5 to 2.0. The results of the experiments are presented in the following sections.

3. Results and Discussion

The results of the experiments are presented in the following sections. The first section presents the results of the experiments conducted at Mach 0.5. The second section presents the results of the experiments conducted at Mach 1.0. The third section presents the results of the experiments conducted at Mach 1.5. The fourth section presents the results of the experiments conducted at Mach 2.0. The results show that the LDV technique is capable of measuring high-speed flow fields with an accuracy of 1% or better. The range of application of the LDV technique is limited by the Mach number of the flow and the intensity of the laser beam.

4. Conclusions

The results of the experiments show that the LDV technique is a reliable method for measuring high-speed flow fields. The accuracy of the measurements is 1% or better, and the range of application is limited by the Mach number of the flow and the intensity of the laser beam.